

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

PLOUGMANN & VINGTOFT A/S
Sankt Annæ Plads 11
P.O. Box 3007
DK-1021 Copenhagen K
DANEMARK

| | |
|--|--|
| Date of mailing (day/month/year) 29 January 2002 (29.01.02) | IMPORTANT NOTIFICATION |
| Applicant's or agent's file reference 23243 PC1 | |
| International application No. PCT/DK00/00298 | International filing date (day/month/year) 31 May 2000 (31.05.00) |

1. The following indications appeared on record concerning:

☐ the applicant ☐ the inventor ☒ the agent ☐ the common representative

| | | |
|---|----------------------------------|--------------------|
| Name and Address PLOUGMANN, VINGTOFT & PARTNERS A/S Sankt Annæ Plads 11 P.O. Box 3007 DK-1021 Copenhagen K Denmark | State of Nationality | State of Residence |
| | Telephone No. +45 33 63 93 00 | |
| | Facsimile No. +45 33 63 96 00 | |
| | Teleprinter No. | |

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☐ the address ☐ the nationality ☐ the residence

| | | |
|---|----------------------------------|--------------------|
| Name and Address PLOUGMANN & VINGTOFT A/S Sankt Annæ Plads 11 P.O. Box 3007 DK-1021 Copenhagen K Denmark | State of Nationality | State of Residence |
| | Telephone No. +45 33 63 93 00 | |
| | Facsimile No. +45 33 63 96 00 | |
| | Teleprinter No. | |

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☐ the International Preliminary Examining Authority ☐ other:

| | |
|---|---|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer François BAECHLER Telephone No.: (41-22) 338.83.38 |
|---|---|

PATENT COOPERATION TREATY

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From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

PLOUGMANN, VINGTOFT & PARTNERS A/S
Sankt Annæ Plads 11
P.O. Box 3007
DK-1021 Copenhagen K
DANEMARK

| | |
|---|--|
| Date of mailing (day/month/year) 16 November 2001 (16.11.01) | IMPORTANT NOTIFICATION |
| Applicant's or agent's file reference 23243 PC1 | |
| International application No. PCT/DK00/00298 | International filing date (day/month/year) 31 May 2000 (31.05.00) |

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

| | | |
|--|----------------------------|--------------------------|
| Name and Address MICROTRONIC A/S Bylledet 12-14 P.O. Box 289 DK-4000 Roskilde Denmark | State of Nationality DK | State of Residence DK |
| | Telephone No. | |
| | Facsimile No. | |
| | Teleprinter No. | |

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person ☒ the name ☒ the address ☐ the nationality ☐ the residence

| | | |
|--|----------------------------|--------------------------|
| Name and Address TECHTRONIC A/S Algade 43 DK-4000 Roskilde Denmark | State of Nationality DK | State of Residence DK |
| | Telephone No. | |
| | Facsimile No. | |
| | Teleprinter No. | |

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☐ the International Preliminary Examining Authority ☐ other:

| | |
|---|---|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer François BAECHLER Telephone No.: (41-22) 338.83.38 |
|---|---|

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

| | |
|--|---|
| Date of mailing (day/month/year) 05 September 2001 (05.09.01) | |
| International application No. PCT/DK00/00298 | Applicant's or agent's file reference 23243 PC1 |
| International filing date (day/month/year) 31 May 2000 (31.05.00) | Priority date (day/month/year) 10 June 1999 (10.06.99) |
| Applicant JØRGENSEN, Martin, Bondo et al | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 29 December 2000 (29.12.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer Odile ALIU Telephone No.: (41-22) 338.83.38 |
|---|--|

PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

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| International application No. PCT/DK00/00298 | Applicant's or agent's file reference 23243 PC1 |
| International filing date (day/month/year) 31 May 2000 (31.05.00) | Priority date (day/month/year) 10 June 1999 (10.06.99) |
| Applicant JØRGENSEN, Martin, Bondo et al | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 29 December 2000 (29.12.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer Odile ALIU Telephone No.: (41-22) 338.83.38 |
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PATENT COOPERATION TREATY

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2011 South Clark Place Room
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Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|--|---|
| Date of mailing (day/month/year) 05 February 2001 (05.02.01) | |
| International application No. PCT/DK00/00298 | Applicant's or agent's file reference 23243 PC1 |
| International filing date (day/month/year) 31 May 2000 (31.05.00) | Priority date (day/month/year) 10 June 1999 (10.06.99) |
| Applicant JØRGENSEN, Martin, Bondo et al | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

29 December 2000 (29.12.00)

☐ in a notice effecting later election filed with the International Bureau on:
2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer R. E. Stoffel Telephone No.: (41-22) 338.83.38 |
|---|---|

PATENT COOPERATION TREATY

PCT

REC'D 17 JUL 2001

WIPO

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|---|---|--|
| Applicant's or agent's file reference 23243 PC1 | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/DK00/00298 | International filing date (day/month/year) 31/05/2000 | Priority date (day/month/year) 10/06/1999 |
| International Patent Classification (IPC) or national classification and IPC H01H19/00 | | |
| Applicant MICROTRONIC A/S et al | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

| | |
|---|--|
| Date of submission of the demand 29/12/2000 | Date of completion of this report 13.07.2001 |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized officer Sembritzki, G Telephone No. +49 89 2399 2371  |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00298

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-10 as originally filed

Claims, No.:

1-16 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00298

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|--------|
| Novelty (N) | Yes: | Claims | 1 - 16 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 1 - 16 |
| | No: | Claims | |
| Industrial applicability (IA) | Yes: | Claims | 1 - 16 |
| | No: | Claims | |

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

V.1

The closest state of the art for the subject matter of claim 1, directed to an encoder-switch assembly is comprised in EP-A 0 901 262 (D1). The known encoder-switch comprises a frame which is displaceable supported relative to a housing. A spring is provided as a biasing or returning means for urging the encoder-switch away from a printed circuit board.

Having regard to the features that the returning means is made from a plate-shaped resilient material and is constituted by the frame the subject matter of claim 1 is new; Art.33(2)PCT.

The features distinguishing the subject matter of claim 1 vis-à-vis the closest prior art result in an encoder-switch having fewer and simpler mechanical parts. None of the documents to be taken into consideration gives a hint to realize an encoder switch having all the features of claim 1 in combination; Art.33(3). PCT.

The subject matter of claim 1 is without any doubt industrial applicable; Art.33(4) PCT.

V.2

Again, D1 is to be taken into consideration as comprising the closest prior art for the subject matter of independent claim 13. The subject matter of claim 13 is new vis-à-vis the closest prior art in that the coding member is fixedly connected to the frame and the cylindrical roller is rotatably mounted in relation to the coding member; Art.33(2)PCT.

The reasoning given above under Art.33(3) and (4) PCT applies for claim 13.

Dependent claims 2 - 12 and 14 - 16 are supported by their respective independent claims.

Re Item VII

Certain defects in the international application

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

Re Item VIII

Certain observations on the international application

Although claims 1 and 13 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, claims 1 and 13 do not meet the requirements of Article 6 PCT.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|---|---|--|
| Applicant's or agent's file reference 23243 PC1 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/DK 00/ 00298 | International filing date (day/month/year) 31/05/2000 | (Earliest) Priority Date (day/month/year) 10/06/1999 |
| Applicant MICROTRONIC A/S | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

2



None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/DK 00/00298

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01H19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01H H03M G06K G06F G05C H03K G01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| Y ✓ | EP 0 901 262 A (NOKIA MOBILE PHONES LTD) 10 March 1999 (1999-03-10) the whole document | 1,2,5,7, 8,13,14 |
| Y ✓ | EP 0 874 382 A (MATSUSHITA ELECTRIC IND CO LTD) 28 October 1998 (1998-10-28) the whole document | 1,2,5,7, 8,13,14 |
| A ✓ | GB 2 260 598 A (SMK KK) 21 April 1993 (1993-04-21) abstract; figures 1,2 | 1-6 |
| A ✓ | EP 0 531 829 A (SONY CORP ;ALPS ELECTRIC CO LTD (JP)) 17 March 1993 (1993-03-17) abstract; figure 2 | 1 |

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

2 August 2000

Date of mailing of the international search report

09/08/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Overdijk, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/DK 00/00298

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|----------------------------|---------------------|
| EP 0901262 | A | 10-03-1999 | AU 8079698 | A 18-03-1999 |
| | | | BR 9803321 | A 14-12-1999 |
| | | | CN 1227997 | A 08-09-1999 |
| | | | GB 2329070 | A 10-03-1999 |
| | | | GB 2329083 | A 10-03-1999 |
| | | | GB 2329094 | A 10-03-1999 |
| | | | JP 11168540 | A 22-06-1999 |
| EP 0874382 | A | 28-10-1998 | JP 11007865 | A 12-01-1999 |
| | | | DE 69800075 | D 16-03-2000 |
| | | | DE 69800075 | T 13-07-2000 |
| | | | US 5886310 | A 23-03-1999 |
| GB 2260598 | A | 21-04-1993 | NONE | |
| EP 0531829 | A | 17-03-1993 | JP 2968875 | B 02-11-1999 |
| | | | JP 5064273 | A 12-03-1993 |
| | | | DE 69225933 | D 23-07-1998 |
| | | | DE 69225933 | T 18-02-1999 |
| | | | US 5448240 | A 05-09-1995 |

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 December 2000 (21.12.2000)

PCT

(10) International Publication Number
WO 00/77806 A1

(51) International Patent Classification⁷: **H01H 19/00**

(21) International Application Number: **PCT/DK00/00298**

(22) International Filing Date: **31 May 2000 (31.05.2000)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:
PA 1999 00824 ✓ 10 June 1999 (10.06.1999) **DK**

(71) Applicant (for all designated States except US): **MI-CROTRONIC A/S [DK/DK];** Byleddet 12-14, P.O. Box 289, DK-4000 Roskilde (DK).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **JØRGENSEN, Martin, Bondo [DK/DK];** Lupinhaven 36, DK-2765 Smørum (DK). **RAVNKILDE, Søren [DK/DK];** Baltorpvej 101, DK-2750 Ballerup (DK).

(74) Agent: **PLOUGMANN, VINGTOFT & PARTNERS A/S;** Sankt Annæ Plads 11, P.O. Box 3007, DK-1021 Copenhagen K (DK).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

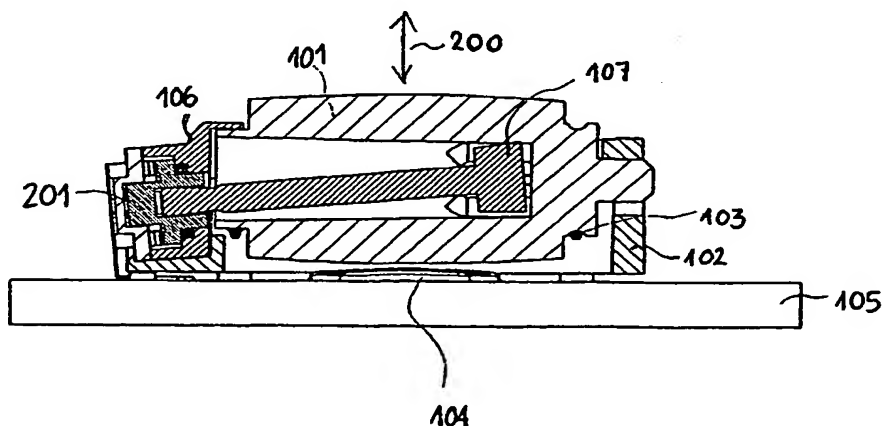
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **ENCODER**



(57) Abstract: The present invention relates to an electromechanical roller-key assembly of simple and robust construction. The assembly may be integrated in electronic equipment and generate digital control signals in response to an instantaneous change in angular position of a user-operated roller. The roller-key assembly according to the present invention is suitable for being manufactured with very small outer dimensions and with fewer and simpler mechanical parts compared to prior art roller-key assemblies, thereby making the roller-key assembly suitable for a simplified and automated factory assembly.

WO 00/77806 A1

ENCODER

FIELD OF THE INVENTION

5 The present invention relates to encoder-switch assemblies such as electro-mechanical roller-key assemblies that comprise an encoder part and an actuator switch. The encoder part may operate according to magnetic, optical and/or electromechanical principles and may provide one or several electrical output signals indicating the instantaneous change of angular position of a rotating roller or tuning wheel of the encoder part of the encoder-switch assembly.

The encoder-switch assemblies according to the present invention are particularly well adapted for use in mobile phones or, generally, in any type of electronic equipment that will benefit from the very small outer dimensions and simple construction of the encoder-switch assemblies.

BACKGROUND OF THE INVENTION

Electromechanical roller-key assemblies may be used to generate digital control signals in response to a rotation of a roller or tuning knob and to generate an actuator switch signal in response to a depression. Such rollers are known from e.g. mobile phones. However, the mechanical constructions of these known devices have certain drawbacks due to a large number of miniature movable and stationary parts, often including a tiny detent spring element. This large number of separate parts requires a quite complex and labour intensive assembly procedure to assure that all parts are carefully aligned with respect to each other.

Accordingly, there is a need for an encoder-switch assembly of simplified construction with fewer parts compared to prior art assemblies so as to simplify the assembly procedure, reduce the assembly time and, consequently, lower the costs of integrating such encoder-switch assemblies in today's mobile phones and similar compact electronic equipment.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an electromechanical roller-key assembly of simple and robust construction. The assembly may be integrated in
5 electronic equipment and generate digital control signals in response to the instantaneous change in angular position of a user-operated roller.

It is a further object of the present invention to provide an electromechanical roller-key assembly suitable for being manufactured with very small outer dimensions.
10 Such miniaturisation is a key requirement for applications in e.g. hearing aids, compact mobile phones pagers, medical dispensing devices and similar handheld or body-worn devices, etc.

It is a further object of the present invention to provide an electromechanical roller-
15 key assembly comprising fewer and simpler mechanical parts compared to prior art roller-key assemblies, thereby making the present electromechanical roller-key assembly suitable for a simplified and automated factory assembly.

In a first aspect, the present invention relates to an encoder-switch assembly
20 comprising,

a first member, said first member being supported by a frame and being rotatably mounted in relation to the frame, the frame having a first part and a second part, the first part being adapted to support the first member and being dis-
25 placeable relative to the second part so as to render the first member displaceable in relation to the second part from an initial position to a displaced position,

a coding member engaging the first member in a manner so as to rotate when the first member rotates,
30

means for returning the first member from the displaced position to the initial position,

means for detecting rotation of the coding member in relation to the frame, and

switching means for indicating when the first member is in the displaced position,

5

characterised in that the returning means is made from a plate-shaped resilient material and is constituted by the frame.

Accordingly, a roller-key assembly according to the present invention may be provided with a coding member operating by different sensing principles, such as
10 electromechanical, optical, inductive, capacitive etc. principles.

The frame may be provided in a plate-shaped resilient material e.g. a metallic material of suitable thickness. The first part and the second part of the frame may
15 be separated by one or more indentations to provide regions with higher resiliency compared to regions of the frame abutting the one or more indentations. By attaching the second part to a housing of an apparatus, the frame functions as a torsion bar element when a user depresses the first member in order to activate the switching means. Accordingly, the frame provides a built-in detent spring functionality.
20

The switching means may be adapted to indicate the displaced position of the first member by forming an electrical connection between a protrusion of the first part of the frame and an electrical conductor or pad positioned in a fixed manner relative to the second part of the frame and/or relative to the external housing or casing or frame. This has the advantage that it provides a much simpler actuator switch element compared to prior art membrane switches.
25

The coding member may be integrated with a substantially cylindrically shaped first member by forming a part of the coding member. Said part may be provided
30 by arranging between 5 and 25 protrusions along a substantially axially oriented surface path on an end surface of the cylindrically shaped member.

A disc-shaped metal plate comprising between 5 and 25 holes of dimensions corresponding to the dimensions of the protrusions may be fitted onto the end surface of the first member so as to form a circular and plane encoding disc. The protrusions thus provide a number of non-conducting pads on the encoding disc while
5 the metal areas constitute electrically conducting pads. In this configuration, the intermittently arranged conducting and non-conducting pads may be electrically interconnected by a circular area of the metal plate. The pads and the circular area may be contacted by scanning means comprising a first, a second and a third contact member. The circular area thus provides a conducting path without the
10 intermittent pattern of conduction and non-conducting pads and may be used as an electrical contact path for the third contact member during rotation of the disk.

Each of the contact members may be electrically connected to a corresponding externally accessible pin or terminal. The pins associated with the first and second
15 contact members may each be connected, through a predetermined pull-up resistor, to a voltage supply provided by an electronic apparatus into which the electromechanical encoder is to be integrated. The leg part or pin associated with the third contact member may be directly connected to a ground terminal in the apparatus so that by rotating the encoder disk short circuits and open circuits are in-
20 termittently generated between the first pin and the third pin and between the second pin and the third pin. Consequently, on each of the first and the second pin a pulse train is generated that comprises a number of pulses per revolution of the encoding disk proportional to the number of conducting pads arranged on the encoding disk.

25

The rotatably mounted cylindrically shaped first member may function as a user operated roller. The roller may comprise corrugated grooves disposed along a substantially axially oriented surface path on the end of the cylindrically shaped member opposite to the end that comprises the encoding disc. The grooves may
30 be in contact with a spring member formed in the frame and provide a biasing force against the corrugated grooves, thereby providing a user operating the roller with tactile feedback to assist the user in determining the angular rotation of the roller.

In a second aspect, the present invention relates to an encoder-switch assembly comprising,

a frame,

5

a first member supported by the frame and being rotatably and displaceably mounted in relation to the frame, wherein the first member is rotatable in relation to the frame in a first plane, and wherein the first member is displaceable in relation to the frame between an initial position and a displaced position,

10

a resilient element for returning the first member from the displaced position to the initial position,

switching means for indicating when the first member is in the displaced position,

15

a coding member engaging the first member in a manner so as to rotate when the first member rotates, the coding member being fixedly connected to the frame, and the first member being rotatably mounted in relation to the coding member,

20

means for transferring a rotation of the first member to the coding member, and

means for detecting rotation of the coding member in relation to the frame.

25

The transferring means may comprise a substantially rigid shaft, a first end of said substantially rigid shaft being connected to the first member in a manner so that the shaft is rotatable in relation the first member in a plane not being parallel to the first plane, a second end of said substantially rigid shaft being connected to the coding member in a manner so that the shaft is rotatable in relation the first member in a plane not being parallel to the first plane.

30

Part of the shaft at the first end may have a predetermined geometrical shape. The first member may have a corresponding inverse geometrical shape being adapted to receive and engage part of the shaft in a manner so that a rotation of the first member is transferred from the first member to the shaft, when the first
5 member is rotated in the first plane.

The dimensions of the corresponding inverse geometrical shape of the first member may be larger than the corresponding outer dimensions of the predetermined geometrical shape of the shaft.

10

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, preferred embodiments of electromechanical roller-key assemblies according to the present invention are described with reference to the accompanying drawings, wherein
15

Fig. 1 shows a cross-sectional view and two perspective views of a first embodiment of an electromechanical roller-key assembly according to the present invention,
20

Fig. 2 is a cross-sectional view of the assembled electromechanical roller-key assembly illustrated in Fig. 1,

Fig. 3 shows four different perspective views of various elements of a third embodiment of an electromechanical roller-key assembly according to the present invention,
25

Fig. 4 illustrates a metal frame which forms part of the electromechanical roller-key assembly shown in Fig. 3, and
30

Fig. 5 illustrates an exemplary electromechanical encoder having a suitable disc-shaped coding member for use in the electromechanical roller-key assembly shown in Fig. 3.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows various views of an electromechanical roller-key assembly according to a first preferred embodiment of the invention. A plastic moulded cylindrical roller 101 is rotatably mounted in a supporting frame 102. A detent spring 103 is also mounted on the frame and further attached to or abutting the roller in a manner that allows the roller to return to a rest position after it has been vertically depressed in order to activate a membrane switch 104 which may be positioned below the roller on e.g. a printed circuit board (PCB) 105. The rotation of the roller is transferred to a coding member 201 (Fig. 2) housed in an encoding module 106 by means of a shaft 107 that provides a relatively rigid connection between the roller and the coding member.

Fig. 2 illustrates that predetermined clearance is provided at both ends of the shaft 107, this clearance provides a mechanism that allows the roller 101 to move vertically (in the direction illustrated by arrow 200) without transferring such vertical movement to the encoding module 106. The encoding module 106 and the frame 102 may accordingly be fixed to the same PCB 105 as the membrane switch 104 by directly soldering the three leg parts of contact members 108 (Fig. 1) to corresponding solder pads located on the PCB 105. Consequently, the present embodiment of the invention does not require flexible connection wires or equivalent flexible connecting means in order to transfer electrical signals from the encoding module 106 to detecting circuitry arranged on the PCB 105. Preferably, the electromechanical roller-key assembly also comprised an O-ring 109 (Fig. 1) positioned between the frame 102 and the coding member 201 to seal the encoding module 106 and the coding member 201 from moist and other external contamination.

Fig. 3 shows various elements of an electromechanical roller-key assembly according to another preferred embodiment of the invention. An assembled roller key assembly 350 is also illustrated in a perspective view. A plastic moulded cylindrical roller 101 is rotatably mounted in a metal frame 320. A first end surface of the roller 101 contains a corrugated groove adapted to contact a detention spring pro-

trusion 325 formed in the metal frame 320 when the roller 101 is mounted in the frame 320. A disc-shaped coding member is formed in a second end of the roller 101 by pressing and aligning a number of holes in a metal disc 300 onto a number of corresponding protrusions, which are moulded in the second end of the roller.

5 The holes and protrusions may be arranged along a substantially axially oriented surface path relative to an axis of rotation of the coding member. Accordingly, the second end of the member may constitute an encoding disk comprising a number of intermittently arranged conducting and non-conducting pads. By providing the protrusions on the roller 101 with substantially the same height as the thickness of
10 the metal disc 300 a plane surface of the coding member may be provided and contacted by scanning means comprising a first, a second and a third contact member, 335, 336, and 340, respectively. The third contact member 336 is formed in the metal frame 320 and thereby electrically connected to it. Thereby, during rotation of the coding member, electrical contact is intermittently established from
15 the first and the second contact member, 335 and 340, respectively, to the at least one third contact member and two pulse trains of differing phase with respect to each other may be provided at the leg parts of the first and second contact members by connecting each of the leg parts of the first and second contact member to an appropriate supply voltage through pull-up resistors.

20

The metal frame 320 is preferably manufactured in a single piece of plate-shaped material as illustrated in Fig. 4. The metal frame 320 is divided into a first part (403 and 404) which is adapted to support the roller at its end surfaces, and a second part 322 which can be rigidly mounted in a casing or housing of an apparatus (not
25 shown) in which the roller key assembly is to be integrated.

By providing two indentations, 400 and 401 in Fig. 4, in the metal frame 320 the first part (403 and 404) is made displaceable in relation to the second part 322. Accordingly, when the second part 322 is rigidly mounted in an apparatus housing
30 and a force is applied to the roller, the first part (and the roller holding the coding member) is displaced from a rest or initial position to an activated position and a torsion spring force is created in the first part so as to return the roller to its rest position when the applied force is removed. Accordingly, the frame itself functions

as a detent spring so that there is no need for a separate spring element. Another advantage of the metal frame is it may further act as a de-coupling element of electrostatic charge that may build up on the roller.

- 5 The displacement of the first part may bring an actuator contact 330 which is integrated with the first part of the metal frame 320 in electrical contact with a electrically conducting pad arranged on e.g. a printed circuit board and positioned below the actuator contact 330. Thereby an actuator switch element is integrated together with the electromechanical roller-key assembly 350 and this switch element
10 may provide two level switching signals to a detection circuit in response to a user depressing and releasing the roller.

The first and second contact members 335 and 340 are preferably provided as an integrated part of the metal frame 320. By utilising an insert moulding process, two
15 plastic bearing elements 341 and 342 are attached to the first part of the metal frame. The first and second contact members 335 and 340 must be mechanically and electrically separated from each other and from the metal frame 320 before or after the insert moulding process so as to provide 3 electrically separate contact members. The plastic bearing elements are utilised to mount the roller in a precise
20 predetermined and rotatable manner relative to the metal frame 320 and to the first, second and third contact members.

A mechanical connection in the form of a cross-bar or shaft may be added between elements 403, 404 (Fig. 4) of the metal frame after it has been bend into a
25 U-shape at the marked regions, as illustrated in Fig. 3, thereby providing a frame of improved mechanical stability.

Fig. 5 is a perspective view of a number of separate elements comprised in an exemplary electromechanical encoder unit. A member 502, constituting a first part of
30 the encoder unit, is provided as a single part moulded in a thermoplastic material with or without reinforcement. The member 502 also defines the positions of the non-conducting pads (protrusions) 503 of the encoder unit by means of twelve wedge-shaped protrusions arranged along a substantially axially oriented path

relative to an axis of rotation of the disk. A conducting member 504 which is provided as a circular disk with a centrally located circular aperture 506 constitutes a second part of the encoder unit. This member 504 comprises a number of wedge-shaped apertures 505 adapted to fit into the corresponding protrusions 503 provided in the member 502. The member 504 may be provided by different manufacturing methods such as through insert moulding or through depositing a layer of conductive material in the preferred pattern on the thermo-plastic member 502. The pads are thus arranged as a circular measuring scale between two radial boundaries positioned relatively near to the circumference of the encoding disk, and the circular area may be positioned inside or outside of the circular measuring scale. Thereby, a circular area or path is left without the intermittent pattern of pads so that this path may be used as a contact path for the third contact member during rotation of the disk. The circular aperture 506 is adapted to receive the end part of a shaft 107 that may be operated by a user. Front and rear housing parts 500 and 513, respectively are provided with contact means 512 which provides snap-fit assembly of the housing parts. Furthermore, an inner surface in the rear part 513 is provided with a projection abutting against each of the at least three contact members to provide a contact or bias force between the contact members and the encoding disk.

20

A first electrical conductive terminal or leg part 507 comprises the second contact member (not shown) and a corresponding externally accessible pin 510. Terminal 507, 508 and 509 are, preferably, provided in a solderable material and/or corrosion-resistant material such as copper, silver, gold-coated steel, palladium-nickel, gold-platinum, gold-nickel alloys, etc. Each of the terminals 508 and 509 are also provided with contact members (not shown) and an externally accessible terminal.

25

CLAIMS

1. An encoder-switch assembly comprising,

5 a first member, said first member being supported by a frame and being rotatably mounted in relation to the frame, the frame having a first part and a second part, the first part being adapted to support the first member and being displaceable relative to the second part so as to render the first member displaceable in relation to the second part from an initial position to a displaced position,

10

a coding member engaging the first member in a manner so as to rotate when the first member rotates,

means for returning the first member from the displaced position to the initial position,

15

means for detecting rotation of the coding member in relation to the frame, and

switching means for indicating when the first member is in the displaced position,

20

characterised in that:

the returning means is made from a plate-shaped resilient material and is constituted by the frame.

25

2. An encoder-switch assembly according to claim 1, wherein the frame is made from a plate-shaped resilient material.

30 3. An encoder-switch assembly according to claim 2, wherein the first part and the second part of the frame are separated by one or more indentations.

4. An encoder-switch assembly according to claim 2 or 3, wherein the second part of the frame further comprises engaging means, said engaging means being substantially rigidly attached to corresponding engaging means of an external housing or casing or frame.

5

5. An encoder-switch assembly according to any of the preceding claims, wherein the switching means is adapted to indicate an electrical connection between a protrusion of the first part of the frame and an electrical conductor or pad positioned in a fixed manner relative to the second part of the frame and/or relative to the external housing or casing or frame.

6. An encoder-switch assembly according to any of the preceding claims, wherein part of the coding member is integrated with the first member.

15 7. An encoder-switch assembly according to any of the preceding claims, wherein the first member comprises a substantially cylindrically shaped member having part of the coding member formed on an end surface part.

8. An encoder-switch assembly according to claim 7, wherein part of the coding member is provided by arranging between 5 and 25 protrusions along a substantially axially oriented surface path on the end surface part of the substantially cylindrically shaped member.

9. An encoder-switch assembly according to claim 8, wherein the coding member is formed by mounting a metal disc on the end surface part of the substantially cylindrically shaped member, the metal disc comprising between 5 and 25 holes of dimensions essentially equal to the dimensions of the protrusions of the coding member.

30 10. An encoder-switch assembly according to claim 9, further comprising at least three contact members being adapted to scan the end surface part of the substantially cylindrically shaped member, each contact member having a corresponding leg part.

11. An encoder-switch assembly according to claim 10, wherein the at least three contact members and the corresponding leg parts are constituted by the frame.

12. An encoder-switch assembly according to any of claims 1 -5, wherein the
5 coding member comprises a disc-shaped member comprising a number of intermittently positioned holes along an axially oriented path of the disc-shaped member, and wherein the detecting means comprises a light emitter positioned in a manner so as to transmit light through the holes of the disc-shaped member to a detector positioned in a manner so as to receive light pulses when the disc-
10 shaped member is rotated.

13. An encoder-switch assembly comprising,

a frame,

15

a first member supported by the frame and being rotatably and displaceably mounted in relation to the frame, wherein the first member is rotatable in relation to the frame in a first plane, and wherein the first member is displaceable in relation to the frame between an initial position and a displaced position,

20

a resilient element for returning the first member from the displaced position to the initial position,

25

switching means for indicating when the first member is in the displaced position,

30

a coding member engaging the first member in a manner so as to rotate when the first member rotates, the coding member being fixedly connected to the frame, and the first member being rotatably mounted in relation to the coding member,

means for transferring a rotation of the first member to the coding member, and

means for detecting rotation of the coding member in relation to the frame.

14. An encoder-switch assembly according to claim 13, wherein the transferring means comprises a substantially rigid shaft, a first end of said substantially rigid shaft being connected to the first member in a manner so that the shaft is rotatable in relation the first member in a plane not being parallel to the first plane, a second and of said substantially rigid shaft being connected to the coding member in a manner so that the shaft is rotatable in relation the first member in a plane not being parallel to the first plane.

10

15. An encoder-switch assembly according to claim 14, wherein part of the shaft at the first end has a predetermined geometrical shape and wherein part of the first member has a corresponding inverse geometrical shape being adapted to receive and engage part of the shaft in a manner so that a rotation of the first member is transferred from the first member to the shaft, when the first member is rotated in the first plane.

16. An encoder-switch assembly according to claim 15, where the corresponding inverse geometrical shape of the first member has dimensions larger than the corresponding outer dimensions of the predetermined geometrical shape of the shaft.

20

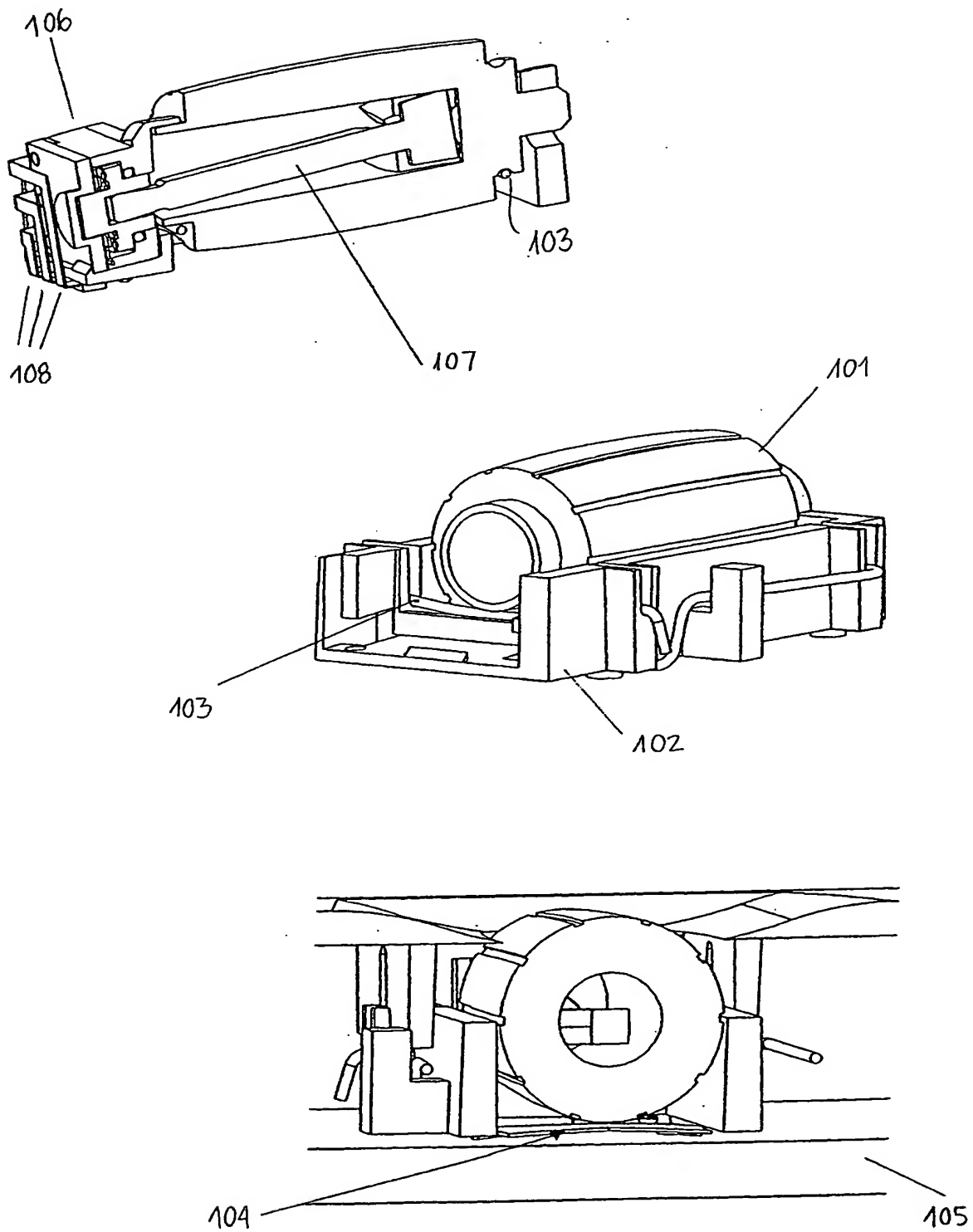
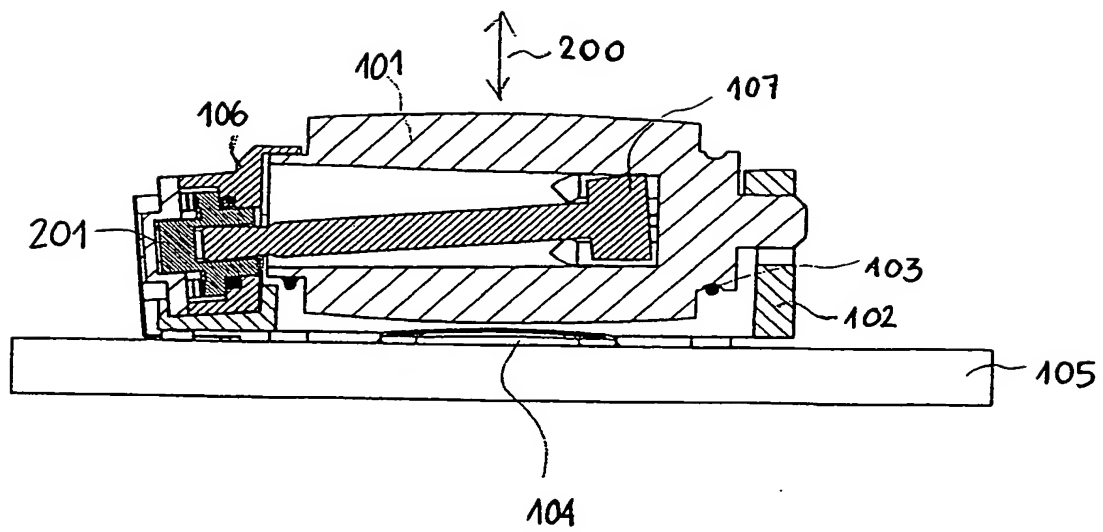


Fig. 1

**Fig. 2**

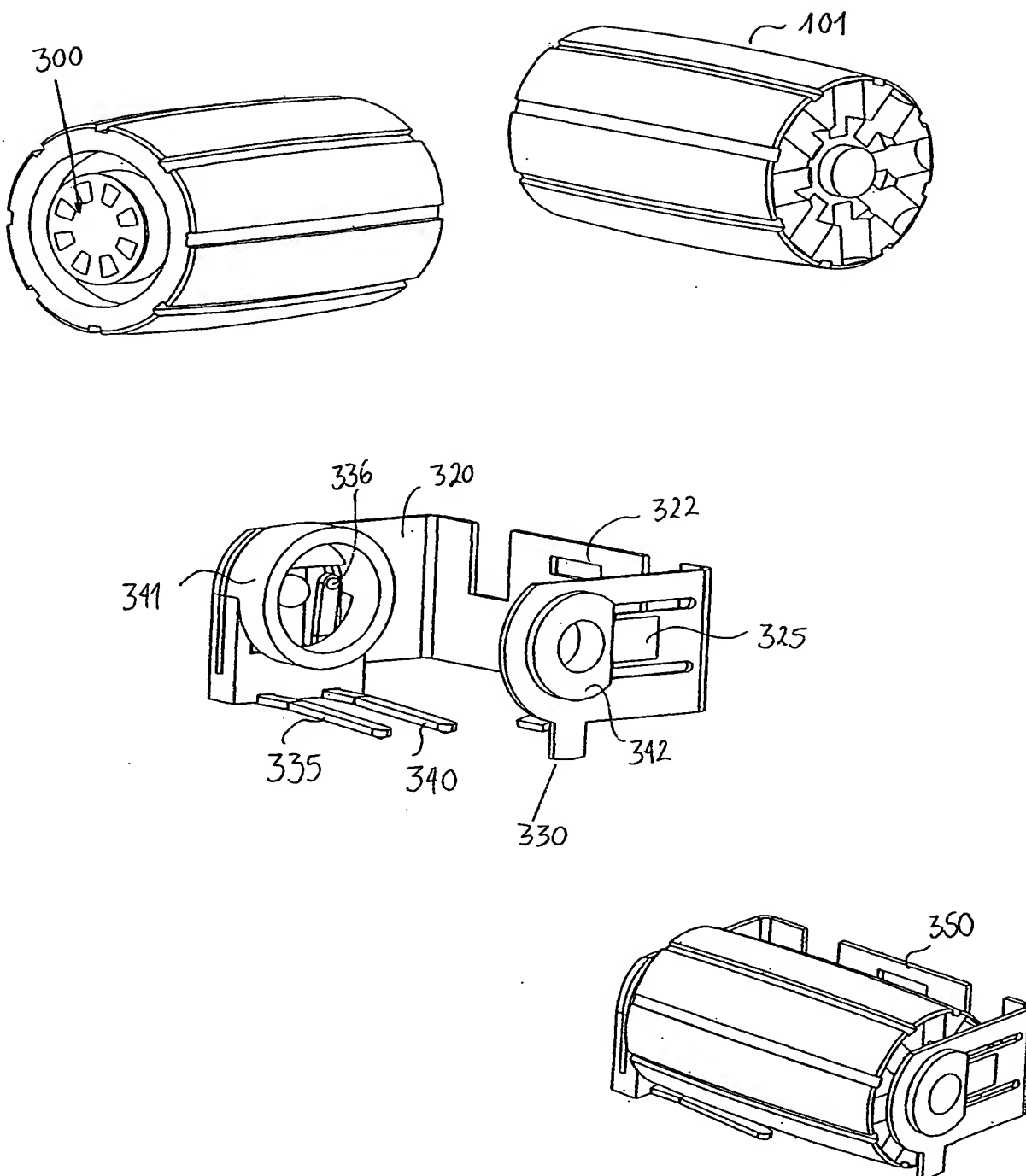


Fig. 3

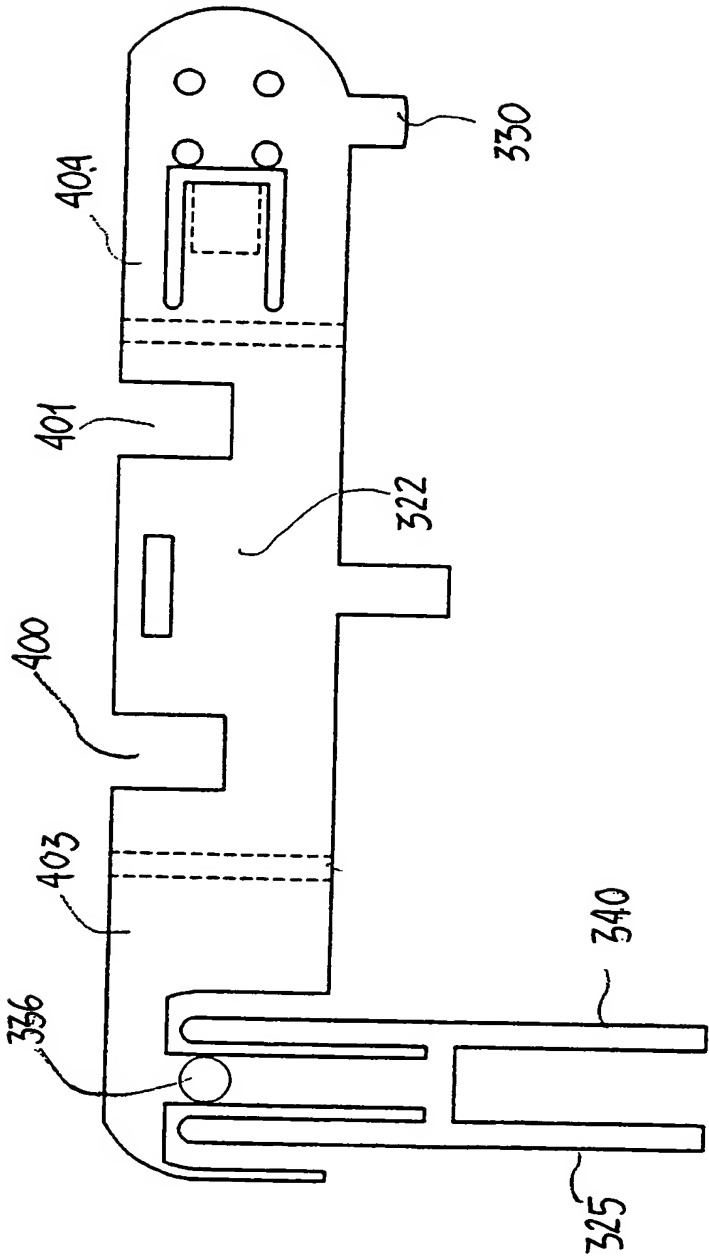
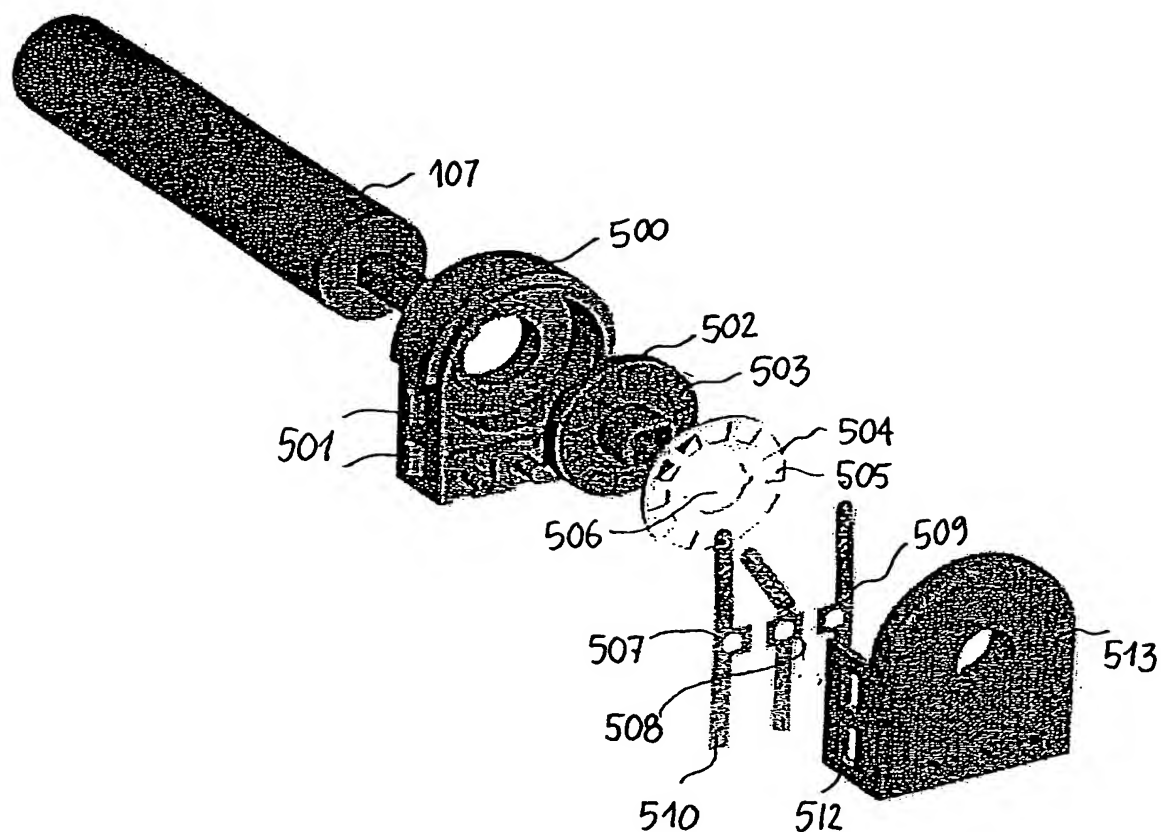


Fig. 4

**Fig. 5**

INTERNATIONAL SEARCH REPORT

International Application No.

PC1/DK 00/00298

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01H19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01H H03M G06K G06F G05C H03K G01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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